

# Application note

## DA9062/3 VBBAT Current in RTC or DELIVERY Modes

AN-PM-068

### Abstract

*This document describes a potential issue that may lead to increased current in RTC mode and DELIVERY mode. A workaround is described.*

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## Terms and definitions

PMIC	Power Management Integrated Circuit
DA9062/3	Dialog DA9062 and DA9063 PMIC devices
RT	Room Temperature

## DA9062/3 VBBAT Current in RTC or DELIVERY Modes

### 1 Introduction

Dialog has identified a condition where increased VBBAT current consumption may be observed when the DA9062/3 enters RTC mode or DELIVERY mode with the VSYS voltage below 1 V.

### 2 Description

In RTC mode and DELIVERY mode with the VSYS voltage below 1 V, it may be observed that the VBBAT current slowly ramps up over time from the normal specified value to several tens of microamps. The magnitude of the current depends on normal silicon process and temperature variations. This application note applies only when VSYS is below approximately 1 V.

The Dialog DA9062/3 PMICs can enter the RTC mode of operation in three different ways:

1. Unconditionally when the VBBAT (backup battery supply) is the only available voltage source in the system (no main battery).
2. If the RTC\_MODE\_PD control bit is set (from OTP or host) and the main PMIC control logic reaches the POWERDOWN state during a power-down sequence.
3. If RTC\_MODE\_SD control bit is set (from OTP or host) and the main PMIC control logic reaches the SHUTDOWN state during a shutdown sequence and the system voltage  $VSYS < VDD\_FAULT\_LOWER$ .

### 3 Workaround

Figure 1 shows a simplified block diagram to create a stable VBBAT current consumption in RTC mode.

The goal is to ensure the VSYS voltage supply is around 1 V at room temperature. At this voltage, the circuit nodes, which lead to an increased  $I_{VBBAT}$  current, are prevented from floating.

The block diagram below shows the DELIVERY mode scenario, where the VBBAT backup battery supply is the only available voltage source in the system (in other words, there is no main battery). The circuit is able to maintain the VSYS supply above 1 V at room temperature which results in a stable VBBAT current consumption.

Figure 1 provides a workaround for scenarios using a rechargeable backup battery.

The value of R in Figure 1 below should be adjusted according to the circuit configuration. The value of R may have to be reduced to account for any additional leakage due to additional loading on the VSYS rail.

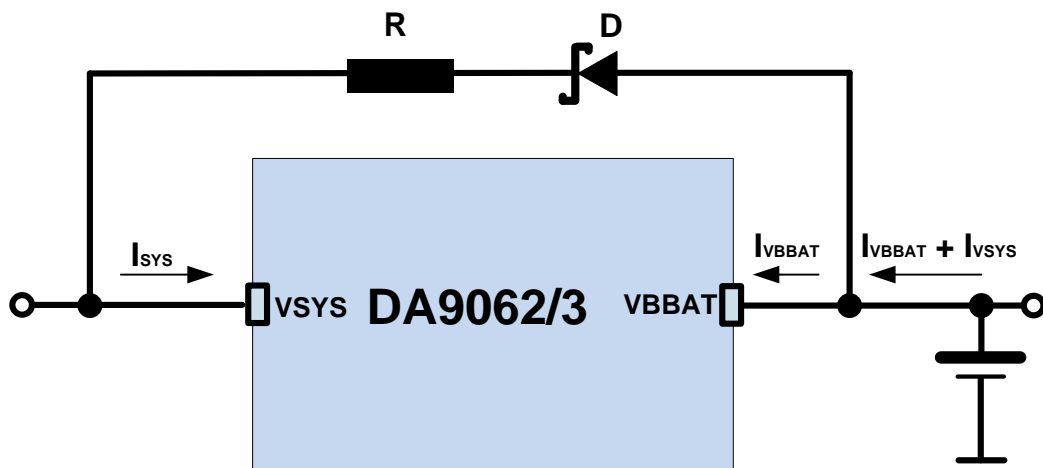


Figure 1: Conceptual Block-Level Diagram

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Figure 2, below, shows a circuit suitable for a primary, non-rechargeable backup battery. This circuit should create a stable VBBAT current consumption in RTC mode. Table 1 lists the external components required for a practical circuit.

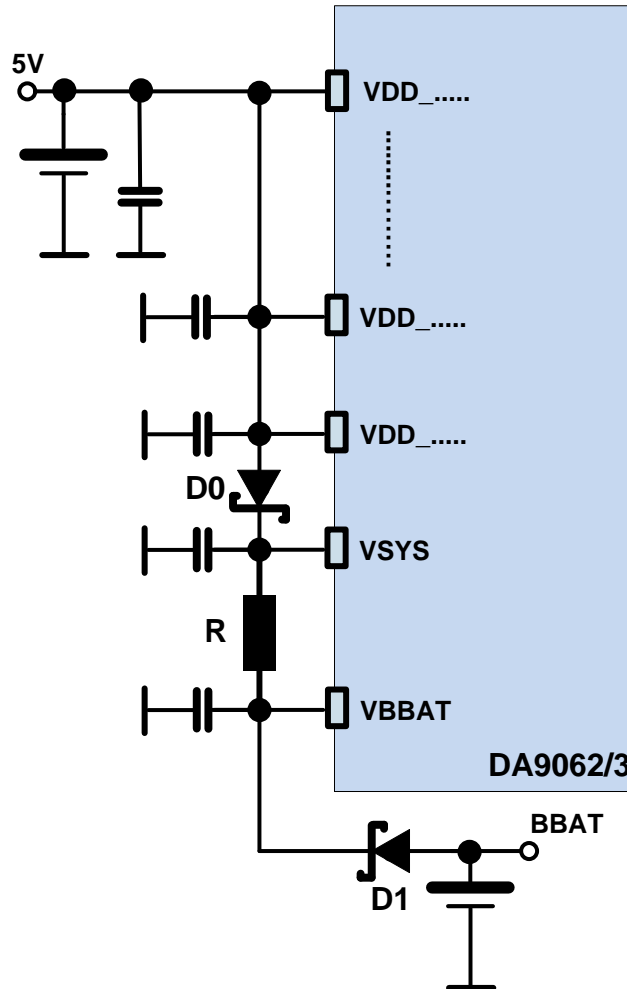


Figure 2: Practical Circuit Example

Diode D0 in Figure 2 provides additional isolation between the main 5 V rail and the VSYS pin. This isolation reduces the risk of additional leakage. However, it should be considered whether the forward voltage of the diode may impact the VSYS operating range.

Table 1: List of External Components

Name	Type	Notes
R	1.5 MΩ	Bias resistor to define VSYS voltage above 1 V at room temperature
D0	Schottky	Supply voltage decoupling diode
D1	Schottky	Supply voltage decoupling diode for VSYS above VBBAT

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3.1 Measurement Results

Figure 3 and Figure 4 show a current consumption measurement in RTC mode, where the increased current consumption is observed. In most cases, the increased current consumption is only observed after several hours.

The plots below show the use of temperature cycling to accelerate the triggering of the floating state and to compare the current consumption measurements with and without external workaround.

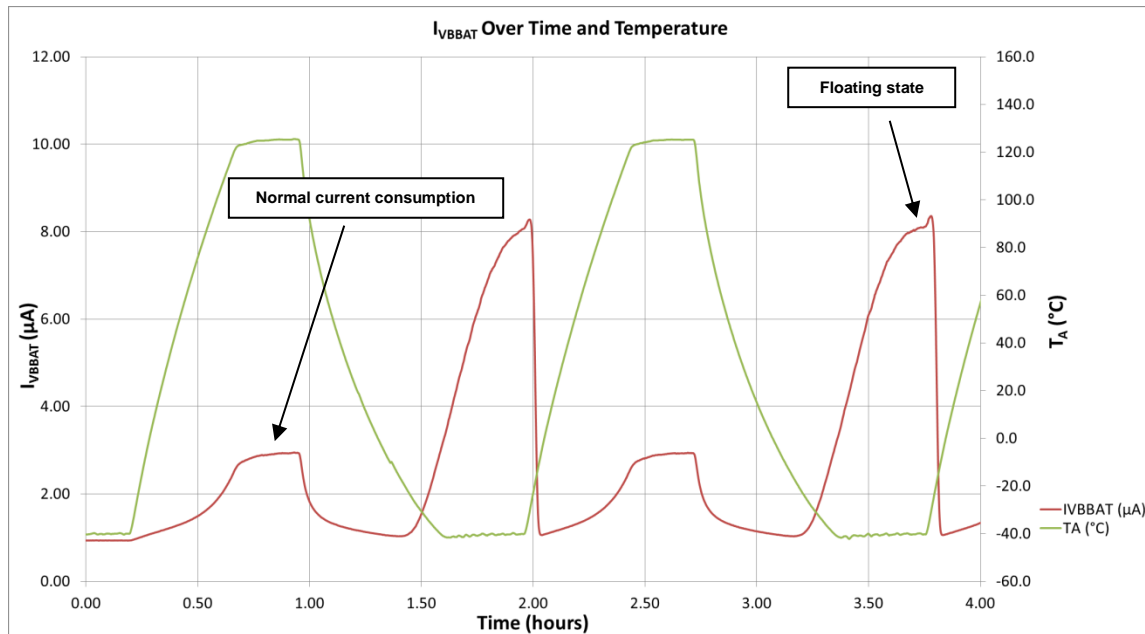


Figure 3:  $I_{VBBAT}$  Current Consumption Without the Workaround, Showing Normal and Floating State Currents

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Figure 4 shows the current consumption measurement result in RTC mode (Figure 1) including the workaround to avoid floating states in the VBBAT voltage domain. The VBBAT current consumption including the workaround only exhibits the normal temperature-dependant variation.

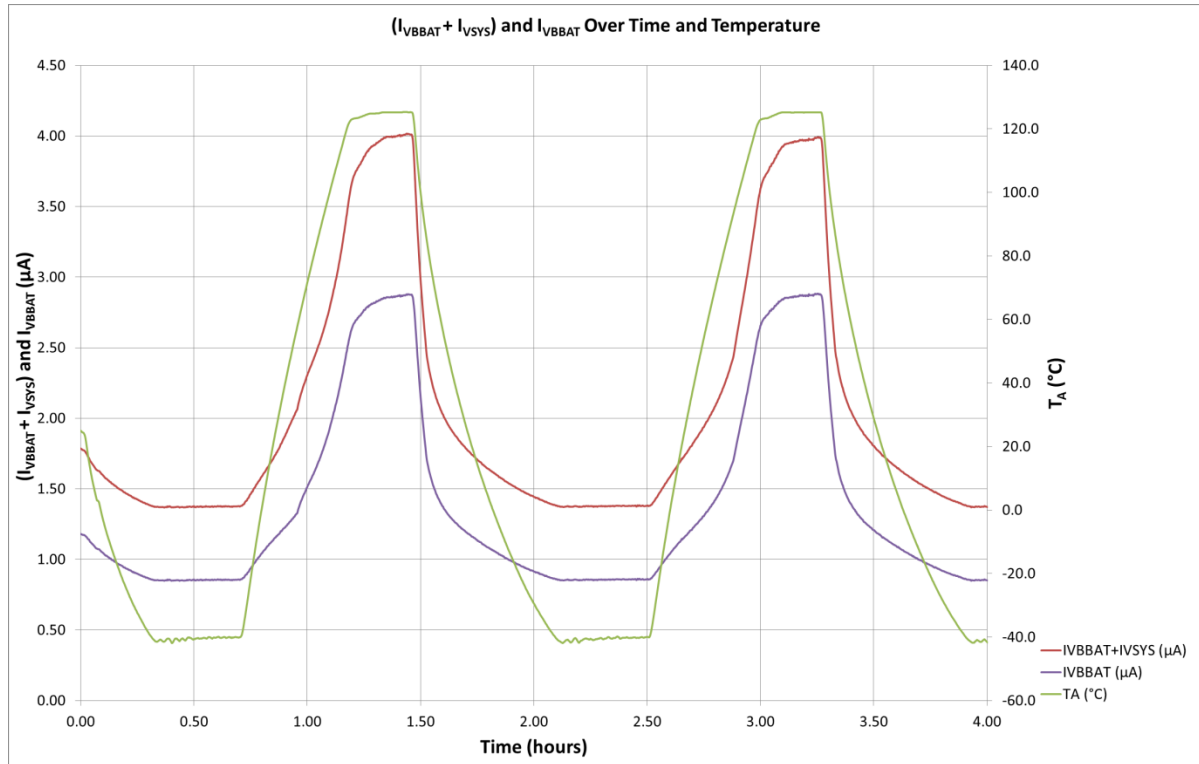


Figure 4: I<sub>VBBAT</sub> and I<sub>VSYS</sub> Current Consumption, With the Proposed Workaround

Table 2: Backup Battery Current for Lifetime Estimation

Condition	T <sub>A</sub> (°C)	I <sub>VBBAT</sub> + I <sub>VSYS</sub> (µA)
Typical	25	2.0
Worst-case	125	6.4

## 4 Conclusion

The DA9062/3 may exhibit higher than expected I<sub>VBBAT</sub> current consumption in either RTC or DELIVERY modes. The addition of a simple workaround can limit this additional current.

For further support for applications using RTC or DELIVERY modes, please contact your local Dialog Applications representative.

## Revision History

Revision	Date	Description
1.0	17- Nov-2015	Initial version
1.1	27- Nov-2017	Minor updates and clarification

## DA9062/3 VBBAT Current in RTC or DELIVERY Modes

### Status definitions

Status	Definition
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